
Functional description

Network environment

NACD employs ISDN D-channel as the vehicle for transport to send NACD call-related messages between sites. Refer to the ISDN NTPs listed under “Supporting documents” on page 59 for a complete description of channeling speech paths.

Only PRI/ISL and tie trunks can be used for Network ACD.

Proper routing requires the dialing plan to identify ACD DN's on different nodes. This function is handled by the Electronic Switched Network (ESN). All nodes on the network must use the same dialing plan: either CDP or VDP. Both plans cannot be used within a single network. Refer to the section on Engineering in this document.

The D-channel is also used to update the databases at the Source and Target nodes. Making new entries in the database triggers a D-channel message to query the far end for verification, before allowing the entry to be registered. When you update your Routing Tables, the system checks the ACD DN address at both ends before allowing the entry to be registered.

D-channel messages also keep the system updated on the operating status of different ACD DN's at separate locations. Source and Target ACD DN's can be local or remote, and Active or Closed. Local Targets are on the same node as the Source ACD DN, and remote Targets are at a different node. An Active status allows the remote Target ACD DN to receive NACD calls. Closed means the remote Target ACD DN is not available to receive NACD calls.

Routing Tables

The ACD DN at a Source node is called the Source ACD DN. The Source ACD DN is always used for routing ISDN messages over the D-channel.

Targets in each table are put in order by the system according to the Target timer value, from the lowest value to the highest value. The timer associated with each Target is used to decide when to issue a Call Request to that Target. The table entries can be entered in any order, and the table is automatically reordered when timer values are changed. If all the timer values are the same, the entries are listed in the order they are entered.

Network ACD uses Routing Tables for the Source ACD DN to direct calls to potential Target ACD DNs. Up to 20 different Targets can be defined for each Source ACD DN. Each Target can have an individual timer defined, from 0 to 1800 seconds. Each entry in the Routing Tables includes the Target ACD DN, an associated timer, and status information for the Target. The Targets in each routing table can be either local or remote.

The Routing Table information is used to determine when and where calls are diverted from the Source ACD DN to Target ACD DNs. There are two types of Routing Tables: Day Tables and Night Tables. The Day Table is used when the Source ACD DN is in Day mode. The Night Table is used when the Source ACD DN is in Night mode.

Calls not allowed to be diverted by NACD are listed here:

- calls with ACD Ring Again activated
- Call Park Recall calls
- calls active in Teleset Messaging
- calls without Disconnect Supervision

Day Tables The Day Table is used when the Source ACD DN is in Day mode. Targets in the Day Table are used independent of the Overflow by Number (OVDN) targets. They can be the same Targets, but they must be redefined in the Routing Table. If no Day Table is defined, then TOF (if enabled) operates as usual.

When a call exceeds the defined timer for a Target in the Day Table, the call remains in the originating queue, and a Call Request is sent to the Target TOF queue. If the call has overflowed by number to a Target node, and the Target timer expires, the call is returned to the Source TOF queue.

These calls are not allowed to access the Day Table:

- Call Park Recalls
- ACD Ring Again calls
- virtual calls (CCR, IVR)

While the ACD DN with a call is in Day Service, the call is monitored to see if it exceeds any other related timers.

Night Table The Night Table provides another night treatment that can be defined for the system. The Night Table is only accessed when an ACD DN is in Night mode.

When the Source ACD DN is in Night mode, the call accesses the Night Table for that ACD DN queue. If there is no Night Table defined, then the Night Call Forward (NCFW) DN is used, if it is enabled.

These calls cannot access the Night Table:

- calls with outstanding Call Requests in the Day Table
- Call Park Recalls
- ACD Ring Again calls
- callers active in Teleset Messaging

If the Night Table is defined, then Night Call Forward (NCFW) does not apply. An error message is output if anyone uses the NITE command in Load Management. Also, the NCFW prompt will not appear in LD 23 if a Night Table is defined.

When a call exceeds the defined timer for a Target in the Night Table, the call remains in the Source ACD DN queue, and a Call Request is sent to that Target. While the Source ACD DN with this call is in Night mode, the call is monitored to see if it exceeds any other Target timers. The call is not routed to its TOF queue, but remains in the incoming call queue.

Table 2
Example routing table (UDP)

Target ID	Timer value	Registered	Status
66552152	0	OK	Active
2108	250	Local	Active
64342998	1800	<blank>	Closed

Target ID This number shows the actual digits dialed. For remote Target ACD DN's, the dialing plans allowed are as follows:

UDP = <AC> <LOC> <ACD DN>

CDP = <DSC> <ACD DN>

where:

AC = Access Code

LOC = Location Code

DSC = Distant Steering Code

Refer to the section on Engineering in this document for more details on dialing plans.

Timer value This is the timer value associated with each Target ACD DN. This value is rounded off to an even number, and gives the amount of time (in seconds) that a call is queued by the Source ACD DN before a Call Request for this call is sent to the Target associated with this timer.

Registered When a Target ACD DN is entered into the Routing Table, the Source node attempts to register itself with the Target ACD DN. Receiving a positive response from the Target node indicates that the Target ACD DN is registered. A source is registered when the Target ACD DN has been queried and responds to the request.

OK indicates that the source is registered with this Target.

Local indicates that the Target defined is local to the Source node. Registration is not required.

<blank> indicates that if this field is blank, the Target has not accepted the Table entry. There has been either no reply or a negative reply from the Target node: the system is down, the network is down, or the DN is not valid.

Status This field describes whether the Target ACD DN is currently able to answer calls or not able to take NACD calls from the Source.

Active indicates that the Target is active or available to accept NACD calls.

Closed indicates that the Target is closed to incoming NACD calls. This occurs for different reasons:

- current number of Call Requests at the Target exceeds its Call Request Queue size (heavy traffic)
- currently in Night mode

Cascade routing

A Call Request from the Source ACD DN is the first message sent to a Target node to queue the call waiting for the next available agent. The call stays at the Source node receiving the treatments defined for that ACD DN (Music, RAN, etc.).

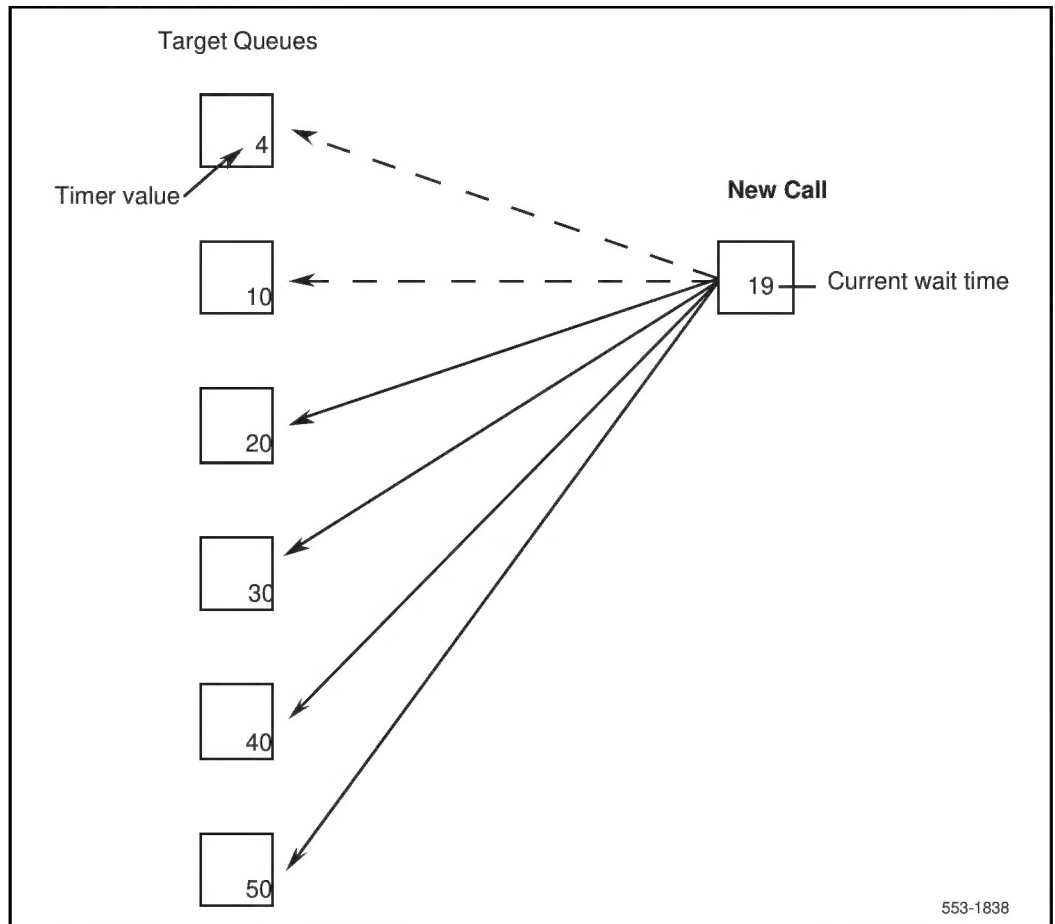
Network ACD sends out Call Requests to search for an available agent within the system. Only one Call Request is sent at a time, but the system continues to search until an agent is found. That is, while the first Call Request is pending at a Target, the system can send another Call Request for the same call to another Target. Up to 20 Call Requests can be pending at any one time.

If the duration timer (DURT) for a particular Target expires before the call is answered, there may be only 19 Call Requests pending. Then, the system resends the Call Requests to maintain the 20 pending. The Cascade occurs as the Call Requests are issued individually, and the system works through the Routing Table issuing Call Requests to Targets with successively longer timers as illustrated in Figure 2.

Targets are arranged automatically according to increasing timer values. The longer a call waits, the farther down the routing table it goes. That is, Call Requests cascade through the listed Targets looking for an available agent. If the timers for each Target are the same value, then the Targets are listed in the order they are entered into the database.

As soon as the call is answered, or abandoned, all pending Call Requests are canceled. That is, the system must follow through the process—Call Request, Free Agent notification, Agent Reserve, and Call Presentation (or abandoned)—and then cancel all outstanding Call Requests for that call.

Figure 2
Cascade routing



Dynamic status change

Certain events and conditions within the system allow the status for a particular queue to change automatically—a dynamic status change. Conditions that cause the status of a Target ACD DN to change are as follows:

- Night Service (NSVC):

When the Target ACD DN goes into Night Service, the status automatically changes to Closed at all its Source ACD DNs. As soon as one agent or supervisor logs in, the ACD DN is taken out of NSVC, and the status is automatically changed to Active.

- Traffic volume:

When calls in the Call Request queue exceed the Call Request Queue Size (CRQS) threshold, the status changes to Closed. The Target ACD DN remains Closed to further network call requests until the calls in the queue fall by the Flow Control Threshold (FCTH) *difference*.

$$\text{CRQS} - \text{FCTH} = \text{difference}$$

Example:

Set these parameters in service change:

$$\text{CRQS} = 80$$

$$\text{FCTH} = 20$$

When the queue = 80, the Target is Closed (CRQS = 80)

When the queue = 60, the Target is Active (CRQS – FCTH = 60)

- Manual Close:

$$\text{CRQS} = 0$$

CRQS can never be lower than the flow control threshold. Setting the CRQS to zero in service change or Load Management closes the queue. The Call Request queue shuts down. When the CRQS is changed to a positive value again, the Target becomes active. The CRQS must be at least the FCTH + 1 or 20, whichever is greater. The maximum value is 255 with a default of 100.

You can also remove or close the queue by removing that ACD DN from the Routing Table for that time frame (Day or Night).

Incoming calls

Incoming calls to a Network ACD site are initially handled as any other ACD application. That is, incoming calls are queued for presentation to the first available agent.

Call Requests

When calls have waited longer than the timer values in the Routing Table, calls can be diverted to Target agents for call presentation. Targets can be local or remote. Calls that are to be diverted to a remote Target remain in the queue for the Source ACD DN, and the software sends a Call Request over the ISDN D-channel to queue Call Requests at the Target node.

When an agent becomes available at the Target node, that agent is reserved for that particular call. The Target node responds to the Source node with an Agent Free notification over the D-channel. Only after receiving the Agent Free notification is the voice call physically diverted from the Source node to the Target node and presented to the reserved agent.

Reserve Agent Timer (RAGT) The Reserve Agent Timer keeps the agent reserved until call presentation or timeout. The timer also prevents a situation where an agent may be reserved indefinitely.

The Reserve Agent Timer is customer defined in service change LD 23 (2 – (4) – 30) and Load Management (RAGT). When an agent is reserved with Countdown Allowed (CNTA) CLS defined in LD 11, the RAGT countdown is shown on the agent's Digit Display.

The agent being reserved has a Reserve Agent Timer with countdown display. The countdown display starts when the Reserve Agent Timer (RAGT) starts, and counts down by increments of 2 seconds, to zero. If the call is not presented to the Target agent before the Reserve Agent Timer (RAGT) expires, that call remains at the originating Source queue. The Target agent is returned to the idle agent queue.

When a call is presented or answered (depending on the display CLS allowed), the Digit Display shows the appropriate call information—dialed DN, DNIS number, CLID, and so on. Diverting the call and system functions show the agent's display to the caller.

CAUTION

Call modification information may be lost.

If the call is transported over a node that does not support the same release or features, certain call information is lost and will *not* be displayed on the terminating telephone.

When a Target agent becomes available, the Target node sends an Agent Free notification message to the Source ACD DN. The agent is removed from the idle agent queue and reserved until the network call is presented. If the timer expires before the call is presented, the agent is returned to the front of the idle agent queue, and the call remains at the Source ACD DN queue. Refer to “Priority Agents” on page 79.

Canceling Call Requests

There are some situations that can change an agent's reserved status or cancel a Call Request, affecting the timer. Agent set key operations can change the status of a station to unreserved. Cancellations for other reasons may be initiated by the Source or Target ACD DNs also.

Source node The Source node cancels Call Requests on the following events:

- call is answered by any agent or supervisor
- call is abandoned

Cancellation messages are sent to all remote Target ACD DNs with Call Requests pending for that ACD call.

Target node A Target ACD DN cancels Call Requests on the following events:

- Duration Timer (DURT) expires
- Reserve Agent Timer (RAGT) expires
- Key Operation: An agent activates keys or logs out before the Call Set-up message is received (as in using the NRD/MSB keys)
- Night Service: If a Target ACD DN goes into Night Service, all pending calls in its Call Request queue are cancelled

Queue priorities

Each agent answers incoming calls based on the priorities established for that ACD DN. There are three different queue configurations that can be defined for Network ACD.

Oldest Call in Network (OCN) This option takes the oldest call in the network overall. This option requires the Oldest Call in Network (OCN) be enabled, and the High-Priority Queue (HPQ) be disabled in LD 23:

OCN = YES

HPQ = NO

The system compares calls from queues for that target ACD DN. The highest priority call that has waited the longest is the call presented to the next available agent.

Own TOF Queue First This option selects the oldest call from the ACD DN's own TOF queue. With this preference, both the Oldest Call in Network option and the High-Priority Queue option should be disabled in LD 23:

OCN = NO

HPQ = NO

If there are no calls in the Source Timed Overflow queue, the system looks at calls in the Call Request queue and Source Timed Local Flow-in queue. If there are no calls in either of those queues, then calls in the High-Priority queue and nonpriority queues are routed next. Calls for a Target ACD DN are best answered by the agents for *that* ACD DN. With this configuration, calls are selected in the following order:

- 1 the oldest call in the agent's own TOF
- 2 the oldest High-Priority call in the Call Request queue or Local Flow-in queue
- 3 High-Priority calls
- 4 nonpriority calls

Own TOF and High-Priority Queue over the network This option presents calls from the agent's own TOF queue and High-Priority queues before presenting calls from Source TOF queues and Call Request queues.

With this preference, the Oldest Call in Network option should be disabled and the High-Priority Queue option should be enabled in LD 23:

OCN = NO

HPQ = YES

With this configuration, calls are selected in the following priority:

- 1 the oldest call in the agent's own TOF queue
- 2 the oldest call in the agent's High-Priority queue
- 3 the oldest call from the Call Request queue or Local Flow-in queue
- 4 the oldest call in the agent's nonpriority queue

Call presentation

The customer must first define call processing priorities for the system, as described in the previous section. Then, the system follows this procedure to present a call to the next available agent. Calls diverted by NACD are placed in the queue for the Source ACD DN, until an agent becomes available for the call.

When an agent becomes available, that agent is reserved by the system for the NACD call. The Reserve Agent Timer starts, to prevent the agent from being reserved indefinitely. During the countdown, the system sends an Agent Free notification over the D-channel to the Source ACD DN.

Receiving the Agent Free notification, the Source ACD DN then diverts the physical voice call to the Target agent reserved for that call. On call presentation the display shows the appropriate information—dialed DN, DNIS number, CLID, for example. Diverting the call and system functions are completely transparent to the caller.

If the Reserve Agent Timer expires before the call can be presented, the call remains at the Source ACD DN.

Interactions

Features and services listed here are described in detail in other publications as ACD features or as software features compatible with Generic X11 software. Refer to the list of supporting documents in the front of this document. If a needed reference cannot be found in that list, please consult with your Northern Telecom representative.

Only calls eligible for TOF treatment are eligible for NACD treatment. The following calls are *not* eligible:

- **ACD Ring Again** If RGA is applied to a call, it is not eligible for NACD.
- **Call Park Recall** Parked calls that time out and recall back to the ACD agent are not eligible for NACD.
- **Non-ACD Interact** Digit translation is not supported on Target IDs within any Routing Table.
- **Teleset Messaging** Calls actively in Teleset Messaging are not supported by NACD.

Network ACD interacts with ACD and basic X11 features of the Meridian 1. These interactions are described in the following section.

ACD interactions

Agent (AGT) Lamps An AGT lamp shows the ACD supervisor the status for every agent in the group. The lamp states, explained in *Automatic Call Distribution feature description* (553-2671-110), are updated every time an agent's status changes.

When an agent is reserved for network calls, the AGT key/lamp on the supervisor's station is in the slow flash state.

ACD Calls Waiting (AWC) The ACD Calls Waiting key uses lamp states to show the agent when the number of calls waiting in the queue has exceeded the customer-defined threshold values. The lamp states work in conjunction with the normal Overflow by Number and Interflow features. However, by an optional command in LD 23, the AWC lamp states are enhanced in the NACD environment.

With the new lamp state option (NCWL) enabled, the Busy Threshold (BYTH) and Overflow Threshold (OVTH) apply only to Overflow by Number and Interflow conditions, but do not change the lamp states. Calls in the Call Request and Local Flow-in queues are included when adding up the calls in queue for lamp state updates.

The new lamp state settings separated from BYTH and OVTH are available to all ACD Package B users with X11 Release 15 or later. Independent of NACD, thresholds that now update lamps are defined by the customer in service change LD 23 and Load Management.

These lamp states are based on the sum of all calls in the following queues:

- the agent's TOF queue
- the agent's High-Priority queue
- the agent's nonpriority queue
- the Local Flow-in queue
- the Call Request queue

Dark	The sum of all calls in these queues is less than the Call Waiting Threshold (CWTH).
Steadily Lit	The sum of all calls in these queues is greater than the CWTH, but less than the Call Waiting Lamp Flash (CWLFL) threshold.
Slow Flash	The sum of all calls in these queues is equal to or greater than the CWLFL threshold, but less than the Call Waiting Lamp Fast Flash (CWLFF) threshold.
Fast Flash	The sum of all calls in these queues is equal to or greater than the CWLFF threshold.

Dialed Number Identification Service (DNIS) The DNIS information is propagated to remote Target nodes. On call presentation, it is displayed on the Digit Display.

If the call is incoming on a non-ISDN trunk, the displayed information includes only the trunk access code, to show that it is an ACD call.

Display Queue (DWC) key The lamp states for the Display Queue (DWC) key are updated for NACD enhancements, as explained above in the Calls Waiting (AWC) description. The DWC display shows queue status in the following format:

a a a – b b b – c c c – d d d d

where:

a a a = sum of calls waiting in queue:
Source TOF, High-Priority, nonpriority

b b b = agent positions available

c c c = waiting time for the oldest call in these queues:
Source TOF, High-Priority, nonpriority

d d d d = sum of all calls in the following queues:
nodal CCR, Flow-in, and Call Request queues

The supervisor can monitor the nodal Flow-in queue separately using the Display (DSP) key. Push the DSP key and dial the Source ACD DN. The display then shows the sum of calls in the Source TOF queue and Call Request queue.

Headset or MSB Logout (HOML) The HOML option allows an agent to log out by removing the headset or going on hook without using the Make Set Busy (MSB) key. Logout while on Agent Reserve causes a cancellation message.

Individual DN (IDN) key The IDN key can be any one of the following key types:

DIG	Dial Intercom Group
HOT	Hot Line
MCN	Multiple Call, Nonringing
MCR	Multiple Call, Ringing
PLN	Private Line, Nonringing
PLR	Private Line, Ringing
SCN	Single Call, Nonringing
SCR	Single Call, Ringing
VCC	Voice Call

When an agent or supervisor activates any IDN key while reserved, a cancellation message is sent to the Source node.

If any IDN key is used by a remote Target agent when being presented with a call from the Call Request queue, the call is terminated to another idle agent. If there are no idle Target agents available, the call remains at the front of the Target TOF queue and will be the first one to be answered.

Call Interflow (IFDN) Call Interflow takes precedence over Network ACD routing. That is, calls diverted to the IFDN are not routed by NACD. Network calls diverted to an IFDN lose all the network information, so that information cannot be displayed on the terminating telephone.

If the Target ACD DN is a local ACD DN, Interflow and recall to Source can be used. If the Target ACD DN is a remote ACD DN or a non-ACD DN, Interflow is not supported.

Disabling Interflow is recommended. Set the timer value to zero (0) in the routing table for those ACD DN's that need calls immediately diverted.

Key features When an agent is reserved, activation of the following keys removes the position from reserved status:

AAG	Answer Agent key
ACNT	Activity Code key
AMG	Answer Emergency key
ASP	Answer Supervisor key
ADL	Auto Dial key
CFN	Call Forward key
MSB	Make Set Busy key
NRD	Not Ready key
OBV	Observe Agent key
RAG	Ring Agent key
SCC and SSC	Speed Call key

If these keys are used by a remote Target agent when being presented with a call from the Call Request queue, the call is terminated to another idle agent. If there are no idle Target agents available, the call remains in the front of the Target TOF queue.

Night Call Forward (NCFW) Night Call Forward is used only if there is no Night Table defined for an ACD DN.

Night Service (NSVC) With NACD, there are three Night Service treatments that can be defined:

- with Night Tables

Callers receive Night RAN, while the call is monitored for the timers defined for Targets nodes.

- Night Tables only

No Night RAN is given, while the call is monitored for the timers defined for Targets.

- Night Tables with Delay Night RAN Route (DNRT)

With active entries in Night Tables (DNRT) on, callers will get Day treatment. The first FRRT must be 4 seconds greater than the timer value of the last entry in the Night Table for this to work. When all entries in the Night Table are inactive, then a Night RAN is returned to inform the caller that the network is closed.

Note: When a caller accesses the queue in Night Service and uses the NACD Night Table (the Night Table has open Targets), the caller hears first and second RAN.

Transition mode:

When the Source ACD DN goes into Night Service via the NSVC key (dialing T [8]), calls already in queue still access the Day Table, but all new calls access the Night Table. If there is no Night Table defined, traditional Night Treatment is given.

Night mode:

The Source ACD DN goes into the Night mode using the NSVC key (dialing N [6]), when all agents log out. Then all calls access the Night Table, unless they have outstanding Call Requests from the Day Table.

- Source node in Night Service
 - Transition mode:
 - new calls access the Night Table
 - existing calls access the Day Table
 - Night mode:
 - new calls access the Night Table
 - existing calls that have pending Call Requests from the Day Table are honored, but there is no more searching of the Day Table
- Target goes into Night Service
 - Transition and Night mode:
 - new Call Requests are denied
 - existing Call Requests are canceled

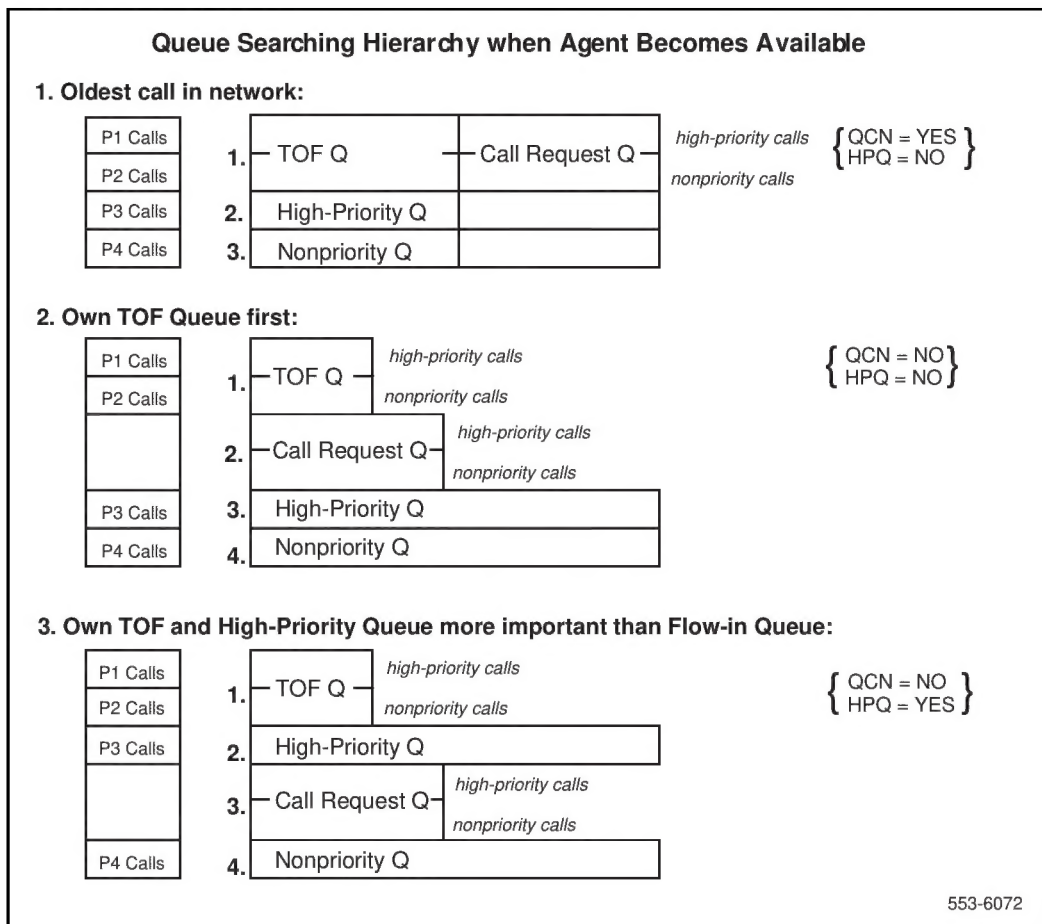
When the Source ACD DN comes out of Night Service, only current Call Requests accessing the Night Table still apply. All new calls access the Day Table. Only calls without outstanding Call Requests can access the Day Table.

Overflow by Number (OVDN) Overflow DNs defined at the OVDN prompt in LD 23 are not used by NACD. They are used by Overflow by Number only. The same ACD DNs can be defined in the NACD Routing Tables as local Targets. OVDN then recalls to Source when the call waits longer than the timer.

Priority Agents (PRI) PRI allows certain agents or groups to have priorities defined for preferential call presentation. Agents or groups with higher priorities are linked more readily to the front of the idle agents queue. Lower priority agents are presented with calls only when all higher priority agents are busy.

If a priority agent is reserved but is not presented with a call, the priority agent will be put after those agents with higher priority and in front of agents with equal priority.

Figure 3
Target agent available



Secondary DN call blocking (SDNB) Secondary DN call blocking prohibits call presentation to an agent's secondary DN while that agent is active on an ACD call.

Secondary DN calls block when an agent is reserved.

If the agent is no longer reserved, and IDN is MADN SCR, the light for that DN flashes.

Time Overflow (TOF) If Routing Tables are not defined, then TOF operates as usual. Refer to the publications listed in "Supporting documents" on page 59 for a complete description of TOF.

Feature interactions

Calling Line Identification (CLID) CLID numbers are sent across the link on call presentation to Target agents. With CLID enabled, the originator's name is sent across the network and displayed on the Target agent's telephone only if each route has Network CPND allowed. Refer to *ISDN Primary Rate Interface Feature description and administration* for more details on Network CPND.

Call Party Name Display (CPND) CPND displays preprogrammed names associated with incoming calls only on M2317, M3000, and Meridian Modular telephones (M2216ACD-1 and M2216ACD-2). Names associated with this feature are only sent across nodes with the CPND package (95) equipped. More complete details on Network CPND are in the *ISDN Primary Rate Interface Feature description and administration*.

Without CLID, a call from outside the network displays the name associated with the incoming route, if the Source node has a name defined for that route.

Call Forcing (FORC) After an ACD call is disconnected (by either party), there is a 2-second delay before the next call is accepted. If the next call is from the Call Request queue, there is an additional delay from 0 to the Reserve Agent Time before the call is presented to the agent.

